Extreme precipitation in the Southeast US:

HMT-Southeast's specialized observations and modeling focus on high-impact forecast challenges

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The Southeast US experiences extreme precipitation events across all seasons and as a result of a number of different meteorological phenomena, making quantitative precipitation forecasting (QPF) and estimation (QPE) in this region especially challenging. The Hydrometeorology Testbed – Southeast Pilot Study (HMT-SEPS) aims to improve accuracy in in analyses and forecasts of precipitation events that lead to flooding through a combination of state-of-the-art observations, extreme precipitation process studies, and high-resolution numerical modeling capabilities.

HMT-SEPS is planned for May 2013 – September 2014 in western North Carolina. The project will be largely focused on quantitative precipitation estimation (QPE) in western portions of North Carolina, but some instrumentation in central and eastern North Carolina will allow for QPE study across a wider region as well. Complementary research on southeast U.S. extreme precipitation events and improved characterization of moisture sources and transport will also be conducted, with a particular focus on gaps and opportunities for improvement in the quantitative precipitation forecasting (QPF) of such events. The combined efforts of the HMT-SEPS field project and the accompanying QPF-related research efforts will together run from spring 2012 through spring 2015. For the HMT-SEPS field project, NOAA will bring a number of instrument assets to the region and leverage additional assets from the NASA Global Precipitation Measurement (GPM) ground validation campaign occurring in the same vicinity. Instruments from existing operational and academic institutions (e.g., Duke University) will also be used. The combined infrastructure will play a key role in the NOAA GPM Proving Ground (along with the GOES-R Proving Ground) to evaluate the baseline skill of existing QPE systems, improve QPE and QPF algorithms, and test new technologies.

To improve predictability of extreme precipitation events, HMT-SE research focuses on (i) improved understanding of key physical processes and moisture sources/transport mechanisms, and (ii) identifying and exploring improvements to forecast gaps and weaknesses. An extreme precipitation event climatology has been created for the region using observations and forecasts of extreme events over the last 12 years. Preliminary results confirm that extreme precipitation events can occur in the Southeast in all seasons and are produced in conjunction with a variety of weather systems, including tropical cyclones, cool-season extratropical cyclones, and warm-season mesoscale convective systems, and within diverse meteorological settings. Forecast improvement opportunities will be established by analyzing both human (e.g., NCEP's Hydrometeorological Prediction Center) and model-generated (e.g., NOAA/ESRL's Global Systems Division (GSD) HMT-Ensemble) forecasts to assess extreme event types that feature higher/lower forecast skill. Model-based case studies of extreme precipitation events will also be used for diagnostic analysis and hypothesis-testing of key extreme events and forecast challenges of interest.

HMT-SEPS research-to-operations transitions will be achieved via collaboration with national centers such as HPC through a combination of real-time and retrospective forecast experiments. For example, HMT-SEPS will participate in the "Intense Precipitation and Flash Flooding Experiment" that will be conducted by HMT-HPC and NSSL in July 2013. In addition, as HMT-SEPS matures, direct collaboration with regional National Weather Service Forecast offices is planned. Finally, experiments performed as part of the Developmental Testbed Center (DTC) and NOAA/ESRL/GSD's HMT-Ensemble forecast system will ideally facilitate HMT connections with NCEP's Environmental Modeling Center to directly contribute forecast system improvements based on outcomes of HMT-SEPS.